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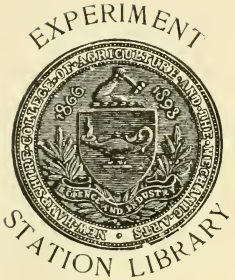

Class 639.73

Number N53

Volume 3 cop 2

Source Binding

Received July 1909

Cost

Accession No. 15435

Bulletin 115 December, 1904

NEW HAMPSHIRE COLLEGE

Agricultural Experiment Station

SIXTEENTH ANNUAL REPORT

NEW HAMPSHIRE COLLEGE

OF

AGRICULTURE AND THE MECHANIC ARTS

DURHAM

AGRICULTURAL EXPERIMENT STATION.

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MABEL H. MEHAFFY, *Stenographer.*

*Resigned September 1, 1904.

SIXTEENTH ANNUAL REPORT.

ANNUAL STATEMENT.

Of the Hatch fund of the New Hampshire College of Agriculture and the Mechanic Arts, for the year ending June 30, 1904.

Receipts.

Cash received from United States treasurer	$15,000.00

Expenditures.

Cash paid for salaries	$8,549.29
labor	1,807.16
publications	1,858.45
postage and stationery	82.18
freight and express	141.48
heat, light, water and power	123.25
chemical supplies	140.15
seeds, plants and sundry supplies	264.76
fertilizers	220.09
feeding stuffs	162.13
library	173.82
tools, implements, and machinery	266.28
furniture and fixtures	188.82
scientific apparatus	515.33
live stock	78.00
traveling expenses	178.03
contingent expenses	22.67
buildings and repairs	228.11
	$15,000.00

We, the undersigned, duly appointed auditors of the corporation, do hereby certify that we have examined the books and accounts of the New Hampshire Agricultural Experiment Station for the fiscal year ended June 30, 1904; that we have found the same well kept and classified as above, and that the receipts for the year from the treasurer of the United States are shown to have been $15,000, and the corresponding disbursements, $15,000; for all of which proper vouchers are on file and have been by us examined and found correct.

And we further certify that the expenditures have been solely for the purposes set forth in the act of congress approved March 2, 1887.

Signed,
C. H. Pettee,
Auditor.

Attest:
Walter M. Parker,
Custodian.

SUPPLEMENTARY STATEMENT.

Receipts.

Cash received, analytical fees, etc. . . .	$1,129.21

Expenditures.

Cash paid for labor	$180.26
freight and express . . .	3.25
heat, light, and water . .	468.13
contingent expenses . .	45.00
buildings and repairs . .	78.07
balance	354.50
	$1,129.21

REPORT OF THE DIRECTOR.

Nov. 1st, 1904.

WILLIAM D. GIBBS.

Satisfactory progress has been made in the work of the year just closing. Since the publication of the last annual report, the following bulletins have been issued in editions of 15,000 each and distributed free of charge:

105. Fruit Growing, with a selected list of Varieties, for New Hampshire (illustrated), 24 pages.
106. Forestry (illustrated), 20 pages.
107. The Brown-Tail Moth in New Hampshire (illustrated), 16 pages.
108. Inspection of Fertilizers, 1903, 12 pages.
109. The Pernicious or San Jose Scale Insect in New Hampshire (illustrated), 12 pages.
110. Experiments in Orchard Management in New England (illustrated), 24 pages.
111. Ten Experiments with Potatoes and Potato Culture for New England (illustrated), 24 pages.
112. Remedies for the Black Fly (illustrated), 8 pages.
113. Experiments in Pig Feeding (illustrated), 8 pages.

In addition to the above, 14 newspaper bulletins, containing summaries of regular bulletins, have been sent to agricultural papers and to the press of the state.

Large numbers of requests for bulletins have been received from all parts of the United States as well as from citizens of the state. The mailing lists have grown to such an extent that it was found necessary to install a mailing machine in order to get the bulletins out promptly.

A department of Dairy Manufactures was added to the Station Work during the year in charge of Instructor Ivan C. Weld, who now has in press a bulletin on "The Babcock Test for Butter Fat," and another in preparation on

"The Extent and Distribution of the Dairy Industry in New Hampshire."

A large amount of experimental work has been done during the season by the Agricultural Department, the results of which will appear in bulletins during the winter months.

The Station met with a serious loss in the resignation of Prof. C. M. Weed, September 1st, to accept a position in the Lowell, Mass., Normal School.

The instalment of the agricultural and horticultural departments in the New Agricultural Building, and the completion of the new range of greenhouses, costing $7,000, adds material efficiency to the Station work.

The progress of the Station departments will be found under the appropriate headings, as reported by the officers in charge.

DEPARTMENT OF CHEMISTRY.

FRED W. MORSE.

The Department of Chemistry has continued a portion of its investigations on the respiration of apples and the composition of silage. An investigation of the soils of the College Farm has been planned, and much preliminary work done in comparing various methods of soil analysis.

There has been more work than usual in connection with the inspection of feeding-stuffs and fertilizers for the Board of Agriculture. Fifty samples of feeding-stuffs and one hundred and twenty-one samples of fertilizers were received and analyzed under these two inspections.

Several analyses of feeding-stuffs were analyzed for the agriculturist of the Station in connection with feeding-experiments. The usual number of miscellaneous analyses of milk, peat, ashes, and cattle-foods were made for individual farmers.

Two samples of flour-middlings were received which are of interest, because of their unusual composition.

One sample was received from Plymouth and the other from Wolfeborough.

Both samples were slightly darker than the average and with a tint resembling clay. In both cases the buyers thought them adulterated with clay. In one case, the jobber claimed the material to be pure middlings from macaroni wheat.

Protein, fat and ash were determined in each with the following results:

Sample.	Protein.	Fat.	Ash.
Plymouth	12.34	2.09	1.34
Wolfeborough	13.43	2.23	1.55

They are evidently not adulterated with any earthy matter, because the ash is low. The protein is unusually low for flour middlings, and also the fat. They apparently contain an unusual amount of flour.

Mr. Harold H. Scudder resigned his position as assistant chemist April 15, and the vacancy was filled a month later by the appointment of Mr. Harry D. Batchelor, a graduate of the college in 1902.

DEPARTMENT OF HORTICULTURE.

F. Wm. Rane.

The work of this department during the year has continued along rather well defined lines, similar in many respects to that reported upon in previous years. Fruit growing, vegetable gardening, floriculture, and forestry have each received attention from the standpoint of experimentation in so far as time would permit.

This department published four bulletins during the year as follows:

January Bulletin, No. 105. "Fruit Growing, with a selected list of Varieties for New Hampshire."

February Bulletin, No. 106. "Forestry.

I. How to make a beginning.

II. Waste Lands: How to convert them into Forests."

March Bulletin, No. 110. "Experiments in Orchard Management in New England."

April Bulletin, No. 111. "Ten Experiments with Potatoes and Potato Culture in New England."

All of the above bulletins have been well received and from the complimentary letters, together with the continued demand for the information here given, it is believed they are being of much service generally.

The investigations and experiments particular to this season have been chiefly as follows:

(1) PLANT BREEDING.

Systematic work was outlined last spring and has been carried out during the summer and fall in this work. The plants in use are Muskmelons, Watermelons, Tomatoes, Peppers, Cucumbers, Potatoes and Squash. Very interesting data have been secured and a beginning made which should eventually give valuable results. I hope that this department may give more attention to this work in the future.

(2) FORESTRY EXPERIMENTS.

We have secured some valuable data on forestry. Definite data as to collecting seeds, digging and transplanting pine tree seedlings, their cost, estimates of handling, etc.

(3) VALUE OF BUG DEATH.

An experiment planned and carried out as to the value of this insecticide has been conducted during the season.

(4) SPRAYING EXPERIMENTS.

As per granted request of the board at the last meeting, we were enabled to carry out the spraying work in a satisfactory manner throughout this season.

(5) EXPERIMENTS WITH THE CABBAGE MAGGOTT.

Some well directed work was begun in an attempt to control this insect. Much valuable data have been gathered and a satisfactory beginning made in overcoming the destructive habits of this pest. It will take at least another season to complete the experiment.

(6) EXPERIMENTS IN PROPAGATING HARDY CUTTINGS.

During the summer Mr. Hall visited the Arnold Arboretum and secured a large number of hardy cuttings. This, together with what has already been done, makes a good beginning. Our aim is to ultimately have all of the shrubs that will withstand our climate.

(7) EXPERIMENTS WITH APPLES IN COLD STORAGE.

Experiments under this head have been carried on for a number of years. I am interested in continuing this work this season and at present we are making arrangements with a commission house in Boston to handle two hundred barrels in cold storage to be sold at various times during the season. There are a number of individual things that are being considered in the same connection, as: nature of packing, particular sorting, varieties for best keepers, color values, time of picking, etc.

(8) VARIETY TESTING EXPERIMENTS.

Our experiments in testing varieties have been up to standard this season and we take pride in the fact that they were complimented by an expert of the U. S. Department of Agriculture.

(9) PROPOSED EXPERIMENTS.

It will require most of our available time for the winter in compiling the accumulated data of the present season. Our usual experimental work under glass will be continued. The plant breeding work, already spoken of, is to

receive as much attention as possible. At this season of the year our plans for next season are also developing.

The new range of greenhouses offers excellent facilities for experimentation. Our work in all lines of greenhouse management and manipulation is getting well under way.

Mr. Harry F. Hall, who for some time has been assistant horticulturist, was promoted to associate horticulturist in June. Mr. Henry M. Sherbert, a graduate of the two-year course in agriculture last June, has been retained as manager of the greenhouses. Mr. Wesley P. Flint, also a graduate in the two-year course last June, is assisting in forestry and general horticulture while pursuing special work in these lines in the college.

DEPARTMENT OF AGRICULTURE.

F. W. Taylor.

The following is a brief and summarized report of the work carried on by the Agricultural Department during the past year:

Considerable work has been done in the reorganization of the department since September 1, 1903. The herd of cattle has been diminished about one half, all of the poorer representatives having been disposed of, and a small number of the best individuals of the different breeds purchased in their stead. A good breeding basis of the Jersey, Guernsey, Shorthorn and Ayrshire breeds has now been secured.

A beginning has been made in the raising of swine, the Berkshire and Medium Yorkshire breeds being represented by excellent individuals. A flock of thoroughbred Southdown sheep has also recently been secured. Much stress has been laid upon the importance of securing representative animals of all the different breeds of live stock purchased, inasmuch as these animals are used both for the purpose of instruction and experimentation.

During the past season a comparative test of the yield of fifteen varieties of corn has been made on one-tenth acre plots. The varieties tested were the following: Longfellow, Improved Yellow Flint, Minnesota King, Sanford's Early White, Angel of Midnight, Race Horse, Early Yellow Canada, Campbell's Best, Thompson, Clarage, Pride of the North, King of the Earlies, Thoroughbred White Dent, Currie's Earliest of All, and Early Longfellow Dent. A test of the yield of ear corn from thick and thin planting has also been made on duplicate twentieth-acre plots.

A comparative test of thirteen varieties of oats was made on tenth-acre plots. The following varieties were tested: Lincoln, Black Gotham, Welcome, Mortgage Lifter, Michigan, Wonder, Improved Prize Cluster, English Wonder, Silver Mine, Black Tartarian, White Maine, White Russian, Golden Fleece, and Mold's Black.

In forage crops the following tests were made:

(a) Methods of securing a stand of alfalfa.
(b) Four varieties of millets.
(c) Three varieties of mangels.
(d) Two varieties of sugar beets.
(e) Three varieties of clover.
(f) Oats and Canada peas.
(g) Soy beans, velvet beans, cow peas and rape.

A comparative test on one fourth acre plots of the cost and effect of different fertilizers on the yield of hay was made.

During August and September a sixty-day feeding experiment with heavy and light oats was conducted. The data on this work embody the results of a chemical analysis of the oats, the relative proportion of hull to kernel in the different grades, and a practical feeding test of them on the six work horses of the college.

A thirty-day feeding test of sweet apples has just been completed on pigs. The pigs in the test received only apples and water, and during the thirty days made an

average gain of only one and one half pounds. The results show that apples alone afford only a maintenance ration. Several other tests on raw and cooked potatoes, "Union grains," and mixed feeds are contemplated for this winter.

In order to secure a field with uniform soil conditions suitable for crop and fertilizer experiments, the four acres of ground, west of the dairy barn and adjacent to the brook, has been laid off into thirty permanent one-tenth acre plots, 217 feet eight inches long, and 20 feet wide, with a two-foot alley-way between them, and into seventeen one-twentieth acre plots, having the same width as the tenth acres. To secure uniform surface drainage, each plot has been plowed as a separate land, with dead furrows coming in the alley-ways. Between every other plot a three-inch tile drain is being laid at an average depth of two and one half feet. The laterals empty into a four-inch main, which runs parallel with the brook and across the plots, 22 feet from their ends. This complete system of tiled drainage is being installed this fall.

An experiment to show the effect of lime on heavy clay soils has just been begun. One half of each of the plots mentioned above has received an application of newly slaked lime at the rate of 40 bushels per acre. Only one half of each plot was limed to show the effect, if any, on whatever succeeding crop may be grown on the plot.

One bulletin, No. 113, "Experiments in Pig Feeding," was published during the year. Three others are now in the course of preparation, *i. e.*, "The relative cost and feeding value of light and heavy oats"; "Underdrainage," with the results of our own work used as a practical basis; "Field Crops," stating the results of the season's work in all plot and field experiments.

DEPARTMENT OF ENTOMOLOGY.

JOHN C. BRIDWELL, ASSISTANT ENTOMOLOGIST.

The work of the department has followed along much the same lines as in previous years, with certain developments and extensions made possible by the more ample accommodations for work in the new quarters in Nesmith Hall. Thus a rearrangement of the insect collections has been made and the work of classifying certain groups has advanced nearly to completion.

The study of the New Hampshire Bumblebees has occupied considerable time. The Station collection of these bees has been carefully studied and the data accumulated in the department have been compiled and many additional observations made.

The work upon the San Jose Scale and the Brown-tail Moth has been continued and wider observations have been possible by the continuance of the Station entomologist as state nursery inspector. In this way the department has had oversight of the work against the Brown-tail Moth in the city of Portsmouth and other places. Bulletins have been issued in regard to each of these pests.

The study of remedies for Black Flies has been carried forward, and a bulletin, giving the result of the work, has been issued.

The work of the Department of Botany has been largely routine work, though many additional illustrations have been made.

Mr. W. P. Flint served very acceptably during the summer as student assistant, co-operating with the Department of Horticulture in the control of insect and fungous pests.

THE INSECT RECORD FOR 1903.

By Clarence M. Weed.

The year 1903 is notable so far as our knowledge of the injurious insects of New Hampshire is concerned by the discovery of a serious infestation of the Brown-tail Moth in the southeastern corner of the state, and the discovery of the San Jose Scale in several new localities. The probability that these insects would be so found has been repeatedly stated in previous issues of this series of Insect Records, while the insects mentioned have been discussed at length in the recently issued Bulletin 109 and Bulletin 111. The year is also notable for the passage of the Nursery Inspection law, which undoubtedly has had a tendency to check the further introduction of these pests.

I have no evidence as yet of the presence of the Gypsy Moth in New Hampshire, though I should not be surprised to hear of its presence in almost any part of the state. This is on the whole the most dangerous insect enemy that threatens us. It is present in vast numbers throughout a wide area in Massachusetts and there is heavy and continuous traffic from this infested region into our state. Freight and passenger trains, horses and carriages, and automobiles are constantly entering our borders, after traversing the infested region. It will be strange indeed if the insect is not brought to us by some of these. And it is by no means certain that the first outbreak will occur along the southern part of the state; it may easily occur in some central or northern region. It is highly important, therefore, that citizens all over the state be warned of the danger from the pest, and be on the alert for any strange hairy caterpillar that attacks the foliage of trees and shrubs. Should this omnivorous pest get a foothold in our beautiful mountains, it would be a most serious calamity, affecting the welfare of the state to an extent that few of our citizens now realize.

Fruit Insects.

The bark-lice of apple and other trees—notably the Oyster-shell Bark-louse and the Scurfy Bark-louse—have continued to attract the attention of fruit growers throughout the state, and have doubtless been doing considerable damage in regions where their presence has not been noticed. Both species have repeatedly been sent to the station with the query as to whether they were the San Jose Scale.

The Apple Aphis was unusually abundant in the southern part of New Hampshire during the early summer. The injury to the young twigs of newly set trees was quite serious. In a small plantation of such trees I found that dipping the infested twigs in a rather weak solution of Bowker's Tree Soap was practicable and efficient. The comparatively few twigs on each tree were bent down and held in the solution a moment, the liquid thus reaching all of the insects among the folded leaves.

Considerable local damage was done by the Canker-worm. A series of experiments conducted by us and not heretofore reported showed that this pest can be controlled by spraying with arsenate of lead or disparene. Our experience emphasized, however, the necessity for early spraying in order that the worms may be killed before too much damage to the foliage is done.

Another apple insect that attracted considerable notice was the Red-humped Apple Caterpillar, which was locally destructive in many parts of the state. This is an insect of peculiar appearance that feeds in colonies upon the leaves of apple trees. It is usually destroyed by simply cutting off the infested twig and killing the larvæ.

The American Tent Caterpillar is slowly increasing in numbers, though the increase in 1903 over 1902 was not so great as had been expected. The good work of birds in keeping these caterpillars in check was very evident, the Baltimore Orioles being especially efficient. The apple maggot was locally quite destructive.

The Apple Leaf-hopper, which was so abundant in 1901 and scarce in 1902, continued scarce in 1903. The insect will probably not become again destructive for several years.

As usual the Plum Curculio was destructive to plums and cherries, and also did considerable damage to apples, causing much of the gruit to be deformed. The Codling Moth was about as injurious as in other recent years.

The various saw-fly larvæ, especially the Imported Currant Worm, the Pear Slug and the Rose Slug, did about the usual damage.

These pests are very easily killed by the use of hellebore, or any of the arsenical insecticides.

Vegetable Insects.

It has been long acknowledged that one of the most perplexing problems in economic entomology is that of the sudden and often apparently unaccountable increase or decrease in the numbers of a large proportion of our insect pests. Reasons for these fluctuations have often been suggested: weather conditions, parasitic and predaceous enemies, birds, and fungous diseases doubtless at times are potent factors in the mysterious changes.

During the season of 1903 there was a very extraordinary attack throughout a large part of New England of the various root-maggots of the genus Anthomyia. Cabbages, cauliflowers and onions were infested to an extent that completely ruined the crop for hundreds of growers. In other years these insects have been vexatious, and occasionally very destructive, but there was a general agreement that the damage this past season was greater than had before been known.

In thinking over possible reasons for this unusual attack, which in my own garden cleaned out rows of onions as fully as could be done with fire, I happened one day to pull up a wild mustard plant and found its roots completely

covered with Anthomyia larvæ. On looking for other mustard plants I was surprised to find them very scarce, and I realized that the ground, which recently came into my possession completely stocked with the seeds of wild mustard, had grown this season very few of these plants. In previous seasons they have sprung up by thousands. It was evident also that it was not a case where the plants had started and been killed by Anthomyians; the plants had not come up at all. And the reason was not far to seek. In early spring, when the wild mustard usually starts, we had an extraordinary drouth which prevented the germination, not only of the seeds planted by the gardener, but also those planted by nature. Of the last the wild mustard is a conspicuous example.

Further observations and inquiries led me to this tentative conclusion:

That usually the wild mustard and allied cruciferous species act as natural trap plants for the eggs of the Anthomyians, germinating abundantly earlier than do cultivated crops, and that this year the failure of the natural trap plants compelled the flies to wait for oviposition until the cultivated plants were ready, thus leading to the extraordinary attack upon them.

These Anthomyians are so difficult to combat that it seems to me this suggestion is at least worth further consideration in the way of observation and experiment.

During late summer and early autumn, the Zebra Caterpillar attracted much attention from owners of gardens. This is a caterpillar with curious black and yellow markings upon its body. It hatches from eggs laid upon the leaves of cabbage and other plants by a purplish brown moth. At first, the larvæ are very dark and feed together in colonies, but as they grow older they become lighter in color and disperse over the plant. When disturbed, they curl up and drop to the ground. They become full grown in a few weeks, when they are about two inches long, with

a wide, longitudinal, velvet-black stripe upon the middle of the back, and two bright yellow stripes upon each side, these latter being connected with each other by five yellow transverse lines. The full-grown caterpillars construct loose cocoons slightly beneath the soil surface, the cocoons being composed of particles of earth fastened together by silken threads. They change to pupæ within these cocoons, and the moths emerge later.

The Black Squash Bug, which so suddenly disappeared in 1902, continued extraordinarily scarce, doing practically no damage to vines. The little Striped Cucumber Beetles, however, were exceedingly destructive, both in their adult and larval stages. Our experience this season demonstrated the necessity of keeping the beetles away from the young plants in order that their eggs may not be laid about the roots. The larvæ that hatch from these eggs burrow through the base of the stalk and the roots and do a great deal of damage. The liberal application of tobacco powder to the hills is the best remedy I have found.

Among the other garden insects, about the usual damage was done. The Bean Weevil continued destructive, as did also the Pea Weevil, while early in the season the flea-beetles were very troublesome on potatoes, tomatoes and similar crops.

METEOROLOGICAL SUMMARY.—1903—1904.

MONTHS.	Average temperature.*		Precipitation.		Snow in inches.		Number of days of .01 inch precipitation.		1903-1904.			
	July 1, 1895, to July 1, 1904.	1903-1904.	Average, July 1, 1895, to July 1, 1904.	1903-1904.	Average, July 1, 1895, to July 1, 1904.	1903-1904.	Average, July 1, 1895, to July 1, 1904.	1903-1904.	Prevailing wind direction.	Days clear.	Days partly cloudy.	Days cloudy.
July	68.9	68.0	3.64	4.92	.....	.....	9	8	N. W.	13	8	10
August	66.0	61.9	3.11	2.67	.....	.....	8	6	N. W.	7	13	11
September	59.5	60.7	4.00	1.73	.....	.....	8	3	N. W.	21	5	4
October	48.0	48.1	3.68	3.74	.....	.....	7	5	N. W.	12	7	12
November	36.5	33.5	3.80	2.04	3.6	.....	8	5	N. W.	13	9	8
December	25.2	21.3	3.71	2.25	9.9	12.0	8	6	N. W.	12	9	10
January	20.1	12.7	4.22	5.59	19.4	32.8	7	7	N. W.	13	6	12
February	21.9	15.3	3.84	3.28	13.7	14.8	7	6	N. W.	12	6	11
March	22.2	29.4	5.11	3.20	10.5	11.5	10	8	N. W.	10	9	12
April	43.5	40.3	3.99	8.61	1.4	6.0	9	12	N. W.	12	7	11
May	55.2	58.8	2.70	3.30	.....	.....	9	9	S. W.	18	5	8
June	63.0	62.0	3.82	5.65	.....	.....	8	6	S. E.	8	6	16
Sum	540.0	512.0	45.62	46.98	58.5	77.1	98	81	N. W.	151	90	125
Mean	45.0	42.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

*Average of 8 a. m. and 8 p. m. observations.

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